Billasurgam: An Upper Palaeolithic Cave Site in South India

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K. THIMMA REDDY

BETAMCHERLA village, (15°25′N, 78°8′E) in the Kurnool district of Andhra Pradesh, is about 50 km from Kurnool town and on the Guntur-Hubli meter gauge of the South Central Railway. The region around Betamcherla abounds in limestone formations belonging to the Kurnool series of the Cuddapah system, which comprises shales, slates, limestones, sandstones, and quartzites. A number of caves, among which Billasurgam, Sanyasula Gavi (*gavi* in Telugu means 'cave'), Yaganti Gavi, Yerrajari Gabbi Gavi, and Muchchatla Chintamanu Gavi are prominent, are situated in the limestone components of the canyons and valleys crisscrossing the low hills and plateaus of the Erramalai hill ranges of the Eastern Ghats. The caves in this limestone area, all of which were developed due to Karst activity, fall into two categories: (1) caves having wide entrances or openings and a large hall or passage that narrows increasingly until it becomes difficult even to crawl through, and (2) caves having narrow passage entrances which ultimately lead to one or more inner chambers.

The Betamcherla caves came to the notice of archaeologists after Newbold's discovery in 1844 of Billasurgam cave, known locally as "Baljegam," situated about 5 km southeast of Betamcherla. Robert Bruce Foote (1884*a*: 27–34) started excavations here which were subsequently entrusted to his son Henry Foote. Excavations were conducted in what are known as Charnel House Cave, Purgatory Cave, and Cathedral Cave (R. B. Foote, 1884*b*: 200–208, 227–235), all located in the Billasurgam Cave.

Material evidence recovered from these excavations includes both archaeological and faunal remains. The archaeological remains comprise bone artifacts such as arrowheads (both barbed and unbarbed), spearheads, scrapers, scraper knives, chisels, awls, and so on. These were compared by Bruce Foote at the time to the Magdalenean of the European Upper Palaeolithic. The faunal remains from

K. Thimma Reddy is affiliated with the Department of Anthropology at Andhra University.

numerous animals (see Appendix) were identified as belonging to Upper Pleistocene times. Unfortunately, this evidence is useless, as the material was lost in transit to London. The absence of a complementary lithic industry characterizing Upper Palaeolithic Culture diminishes further the value of Foote's work.

The Indian Stone Age chronology shows a hiatus between the Middle Palaeolithic and Mesolithic, although some blades and blade flakes which were found in the context of either the former or latter were considered to represent the hiatus. It was only at the close of the last decade that the blade and burin lithic industries from different parts of the Indian subcontinent in general and from the Kurnool, Cuddapah, and Chittoor districts of Andhra Pradesh in particular began to surface. These industries in Andhra Pradesh, occurring independently of the aforementioned two phases, recall, in some traits, the Upper Palaeolithic lithic industries of Europe and West Asia. It was at this juncture that H. D. Sankalia suggested a thorough investigation in the Cuddapah Basin, with special emphasis on the Betamcherla caves, to find a full-fledged Upper Palaeolithic cultural level characterized by both lithic and bone technology as found elsewhere in the Old World.

The investigations in the cave areas of Betamcherla revealed the evidence of blades typical of those found at Yerragondapalem (Reddy in press), Badvel (Reddy and Sudarsen 1978), and Renigunta (Murty 1969), in the Kurnool, Cuddapah, and Chittoor districts, respectively. Excavation was therefore planned under the general guidance of H. D. Sankalia, then director of Deccan College, Poona. The caves under investigation are known as Muchchatla Chintamanu Gavi, Peddapavuralla Badde Gavi, Baljegam or Billasurgam, and Kottala Polimera Gavi. A limited excavation was carried out in the last two caves by the author; the first two caves were excavated by M. L. K. Murty of Deccan College.

BILLASURGAM

This site consists of a group of caves situated about 5 km southeast of Betamcherla and about 1 km southeast of Kottala village (Fig. 1). The cave, a tunnellike passage the roof of which is preserved at places, runs from southeast to northwest. The roof, at places, is about 20 m high. This tunnel appears to have been carved out by surface runoff of water from the hills. Many caves of both categories mentioned earlier are situated mostly on the right side, facing the west.

A deposit 9–10 m thick removed by Henry Foote in the caves did not expose the bottom, indicating the considerable antiquity of the cave sediment. The cave under present study is situated at the southern extension of the tunnel at an elevation of about 3 m from the present stream bed.

Grass cover and scrub jungle of the dry deciduous type provide green vegetation in the cave area, which dries up during the summer months. Small game animals such as hare, hyena, porcupine, and others are still hunted in this region.

Excavation

The cave under present study, at the southern extension of the main passage of Billasurgam, was not tapped by Foote. It faces east and is about 3 m above the stream bed, in the escarpment of about 10 m height. The width of the cave entrance

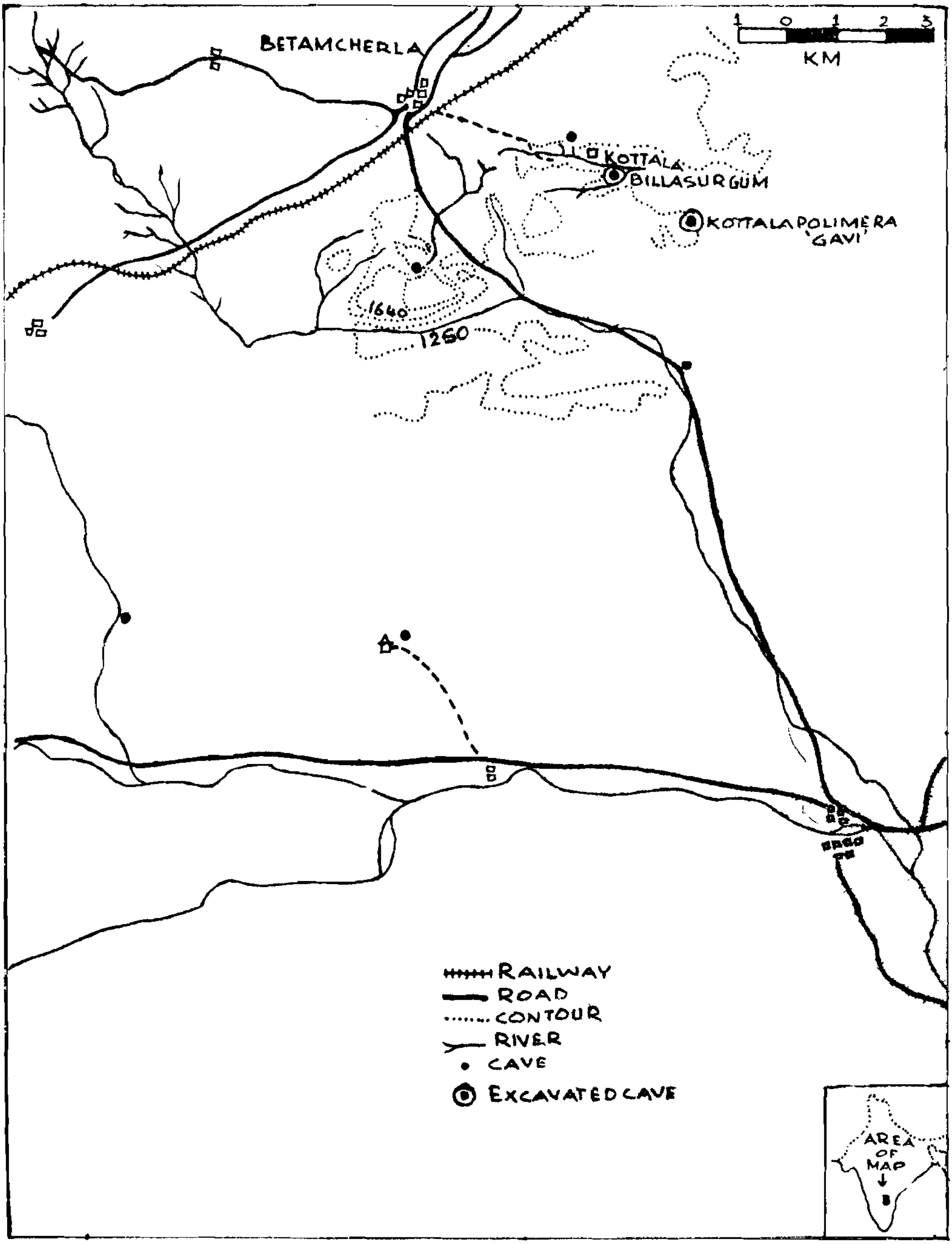

Fig. 1 Map showing the location of Betamcherla Caves, Kurnool District, South India.

is approximately 6 m, becoming narrow as one enters (Plate I*a*). It was about 2 m high before excavation; the deposit extends up to 15 m from its mouth.

A trench measuring 2 × 3 m was laid at the entrance for excavation (Fig. 2). The cave sediment is heterogeneous in nature; its content comprises dark brown loose silt, dull white powdery silt, dull red morrum (lateritic gravel), and light brown compact soil mixed with slabs and chunks of limestone. The nature of the sediment may be described as follows (Fig. 3).

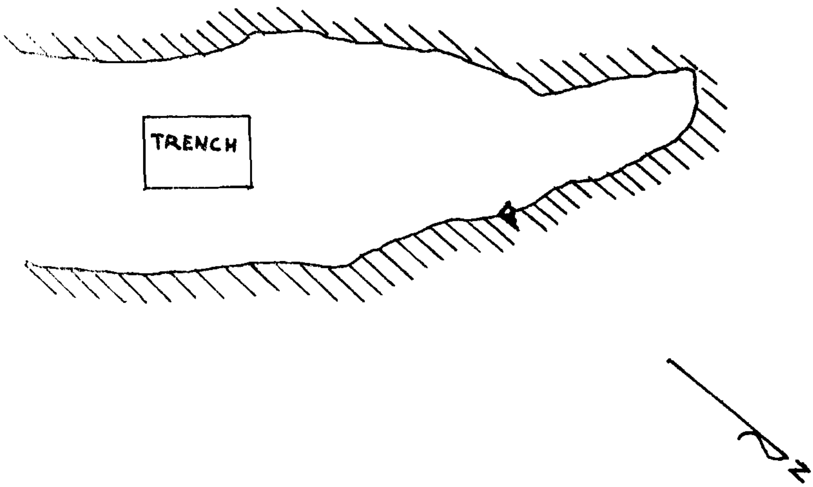

Fig. 2 Billasurgam, trench in relation to the ground plan of the cave. Scale 1 cm = 2 m.

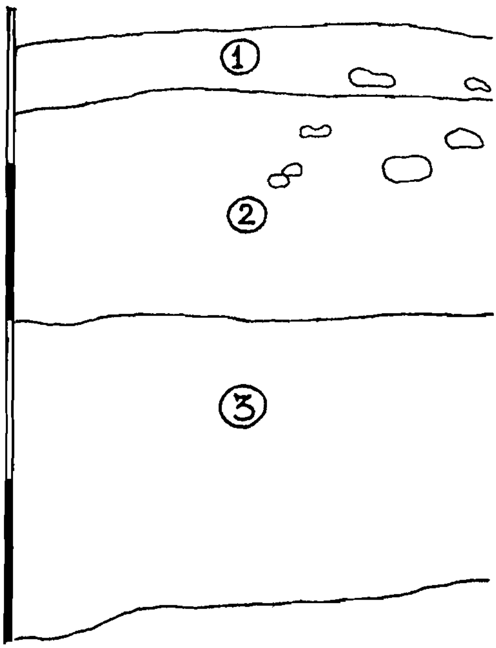

Fig. 3 Billasurgam, section of trench facing southwest.

Layer 1 (1–35 cm)

This layer is composed of dark brown loose silt mixed with bat dung and limestone blocks and chunks to a depth varying between 30–35 cm from the top. Four potsherds of black-painted-on-red ware, blade flakes, flakes, and some cores of limestone and nodules of quartzitic sandstone were found in this level, which was frequently disturbed by guano diggers. The stone artifacts are 382 in number.

Layer 2 (35–155 cm)

This layer is about 120 cm thick and is divided into two sublayers, A and B; A ranges from 35–60 cm and B from 60–155 cm.

Sublayer A: The top portion of the second layer from 35–60 cm consists of dark brown sandy silt, at places compact, and also contains patches of white powdery soil of limestone. Limestone blocks, nodules, chunks, and artifacts on stone and worked bones were found. The color of the soil might be due to its contact with Layer 1.

Sublayer B: This is the lower portion of the second layer and ranges from 60–155 cm. Composed of dull red morrum, it is more compact toward the bottom. The frequency of limestone blocks becomes less, but nodules on limestone and sandstone, chunks and artifacts on limestone increase in number. Worked bones and dental remains were also found.

The artifacts belonging to a blade industry were found continuously from 35–155 cm. Worked stones, blades, flakes, and chips numbering 951 were recovered from Layer 2. A few bone blanks, cut bones, dental remains, and bone splinters, along with some molluscan shells, were also recovered.

Layer 3 (155–350 cm)

The excavation was stopped at a depth of 350 cm, where the composition of the soil changed slightly from the layer above. It was light brown in color and more compact, making the digging a bit difficult. It is kankary after digging. The frequency of stone artifacts, as well as the occurrence of limestone nodules and chunks, became very insignificant, as they number only 13 in total. A few bone splinters were also recovered. Toward the bottom of this layer, no archaeological and osteological material was recovered, although the cave sediment continued.

Kottala Polimera Gavi

This cave is located at the village boundary (Polimera) and about 3 km from Kottala village. Two km southeast of Billasurgam situated in a canyon overlooking the valley, it is a narrow cleftlike passage in the limestone escarpment in which blocks of limestone project horizontally outside. The width of the opening is 75 cm, becoming 40–45 cm after one enters, where it becomes necessary to lie down and crawl sideways to reach the interior. The narrow passage runs for about 20 m, taking different turns, and opens into a chamber on the right side measuring 3 × 2 m. On the left side of the passage, another chamber is located about 5 m farther. Cave sediment of the Billasurgam type is found in both the chambers. Excavating this cave was a very difficult and painstaking process. The original plan

Plate I*a*
Entrance of excavated cave.

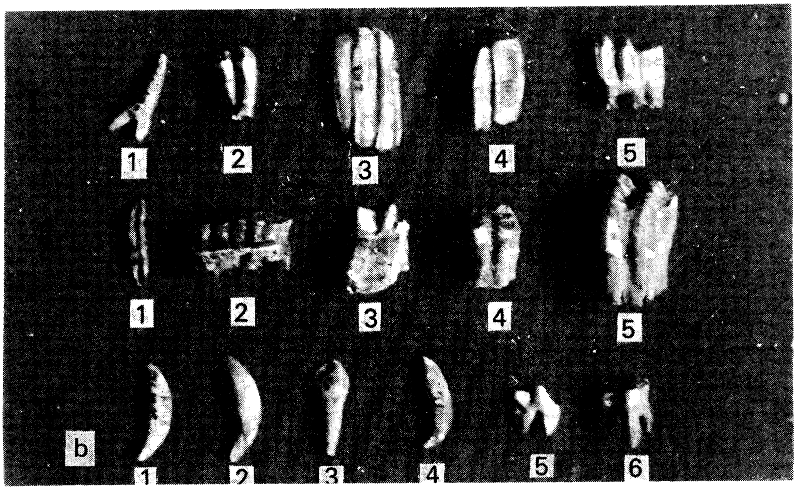

Plate I*b* Top row: *1,* canine of *Ursidae; 2,* molar of *Ovis; 3,* molar of cattle; *4,* molar of *Bovidae; 5,* molar of Hyprodont/Selenodont. Middle row: *1,* incisor of *Equidae; 2,* third premolar and first molar of *Cervidae; 3,* molar of *Suidae; 4,* molar in upper jaw of *Bovidae; 5,* molar of *Bovidae.* Bottom row: *1,* canine of *Leporidae; 2,* canine of *Leporidae; 3,* canine of *Bovidae; 4,* lower canine of *Felis; 5,* premolar of *Leporidae; 6,* molar of ruminant.

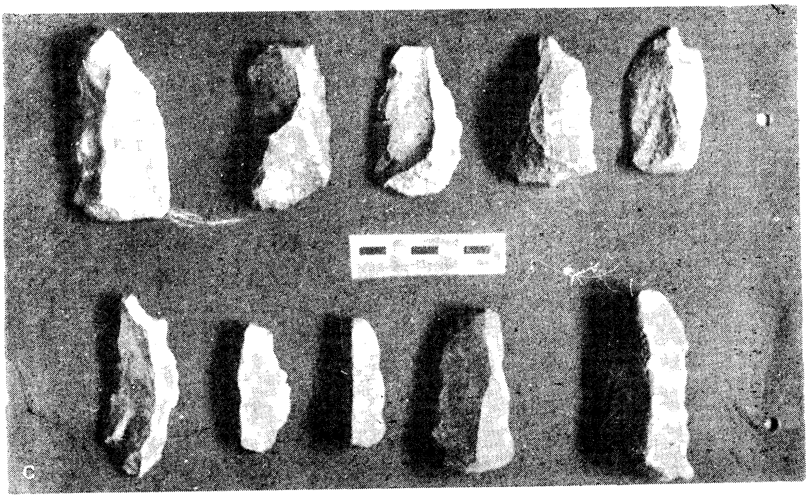

Plate I*c* Surface collection of blades from Billasurgam.

of excavation in the chamber was abandoned because of the very narrow passage and presence of snakes. It was therefore decided to clear the passage at the entrance to observe the nature of cave sediment and of associated archaeological and osteological remains.

Excavation

The passage was excavated for 4 m from the entrance, taking 150 cm, 150 cm, and 100 cm length each time. The passage was quite uneven before excavation. The width ranged from 75–35 cm. Not including the top portion, which was very much disturbed, the cave sediment was uniform. The sediment is described in the following sections.

Layer 1 (1–30 cm)

The upper layer was a debris composed of light brown cave earth and dark brown silt mixed with bat dung. Slabs of limestone and chunks were found in haphazard positions. The soil was loose and appears to have been brought from the inside by guano diggers and discarded after they collected the manure. In content, too, the soil contained a mixture of bones—old and fossilized, and recent and fresh.

Layer 2 (30–150 cm)

This is divided into two parts, A and B.

Sublayer A : This sublayer, ranging from 30–60 cm in depth, was composed of dark brown silt mixed with splices and slabs of limestone. Some slabs were found inclined, some horizontal, and others vertical. A large number of animal remains, comprising dental and osteological specimens, were recovered from this layer. Some of the bones were worked; a few were burnt.

Sublayer B : The thickness of this sublayer ranged from 90 to 60 cm, or to a total depth of 150 cm. It was light brown in color and slightly compact when compared to Layer 2A. The limestone slabs were in the process of disintegration into red and yellow pieces. The archaeological and osteological remains had patches of soil encrustation. The frequency of bones from this level was less. The bones included worked, cut, splintered, and complete bones associated with dental remains. Clearance of the passage was stopped at this depth, as it was difficult to proceed further.

Correlation

Layer 1 of Billasurgam can be equated with Layer 1 of Kottala Polimera Gavi on the basis of content, both being loose sandy silt mixed with bat dung.

Layer 2 of Billasurgam and its two sublayers A and B can be compared with Layer 2 of Kottala Polimera Gavi on the basis of osteological and archaeological evidence.

STONE TOOL INDUSTRY

Stone artifacts, amounting to 1356 in total and all of them from Billasurgam, were recovered from various levels in the excavation. The details are given in

Table 1. Out of these 1356, 240 were treated as finished products or tool types. The occurrence of different tools by type and level is shown in Table 2.

TABLE 1. DISTRIBUTION OF ARTIFACTS BY LEVEL

ARTIFACT/	LAYER 1	LAYER 2A	LAYER 2B				LAYER 3	TOTAL
LEVEL	1–35	35–60	60–90	90–105	105–125	125–155	155–350	
Blades	9	23	17	—	13	98	—	160
Flakes	130	98	60	23	63	84	6	464
Cores	26	37	19	15	28	57	7	189
Core flakes	—	—	—	—	—	6	—	6
Chips	215	117	40	50	50	45	—	517
Hammerstones	2	—	—	2	2	4	—	10
Total	382	275	136	90	156	294	13	1346

TABLE 2. DISTRIBUTION OF FINISHED TOOLS BY LEVEL

TOOL TYPE/	LAYER 1	LAYER 2A	LAYER 2B				LAYER 3	TOTAL
LEVEL	1–35	35–60	60–90	90–105	105–125	125–155	155–350	
Blades	9	19	9	—	6	60	—	103
Burins	—	6	—	—	5	9	—	20
Points	—	12	8	—	4	18	—	42
Borers	—	—	1	—	—	8	—	9
Scrapers	2	14	—	3	3	22	4	48
Arrowheads	—	—	—	—	—	11	—	11
Knife-edged tools:	—	1	—	—	—	6	—	7
Total	11	52	18	3	18	134	4	240

Limestone nodules and chunks, both abundantly available locally, have been employed as raw material in the stone tool industry. This industry, as shown in Tables 1 and 2, included blades, flakes, cores, chips, and so on. The majority of the finished tools, such as burins and points, were made on flakes. Two modes of preparation appear to have been predominantly used in removing these blades and flakes: blade and direct percussion techniques. The occurrence of a large number of blade cores, hammerstones, some pointed objects, and a number of blades would reveal that after preparing the core, the blades were removed with the help of a punch. Flakes were another predominant element. Most of the flakes were simple, with triangular or rectangular shapes. The Levalloisian type of flakes were less common. A stone hammer might have been used to detach flakes from nodules and chunks of limestone; the retouch either on blades or flakes is either rare or poor. All the blades and flakes possessed sharp and thin edges either along two lateral sides or at least along one lateral side. Their sharpness or thinness appears due to the very fine grain structure of limestone. The fact that the majority of these blades and flakes were not retouched indicates that they were considered fit to be used as cutting or scraping tools without retouch. All the artifacts invariably possessed lime encrustation, either fully or in patches, and almost all were patinated.

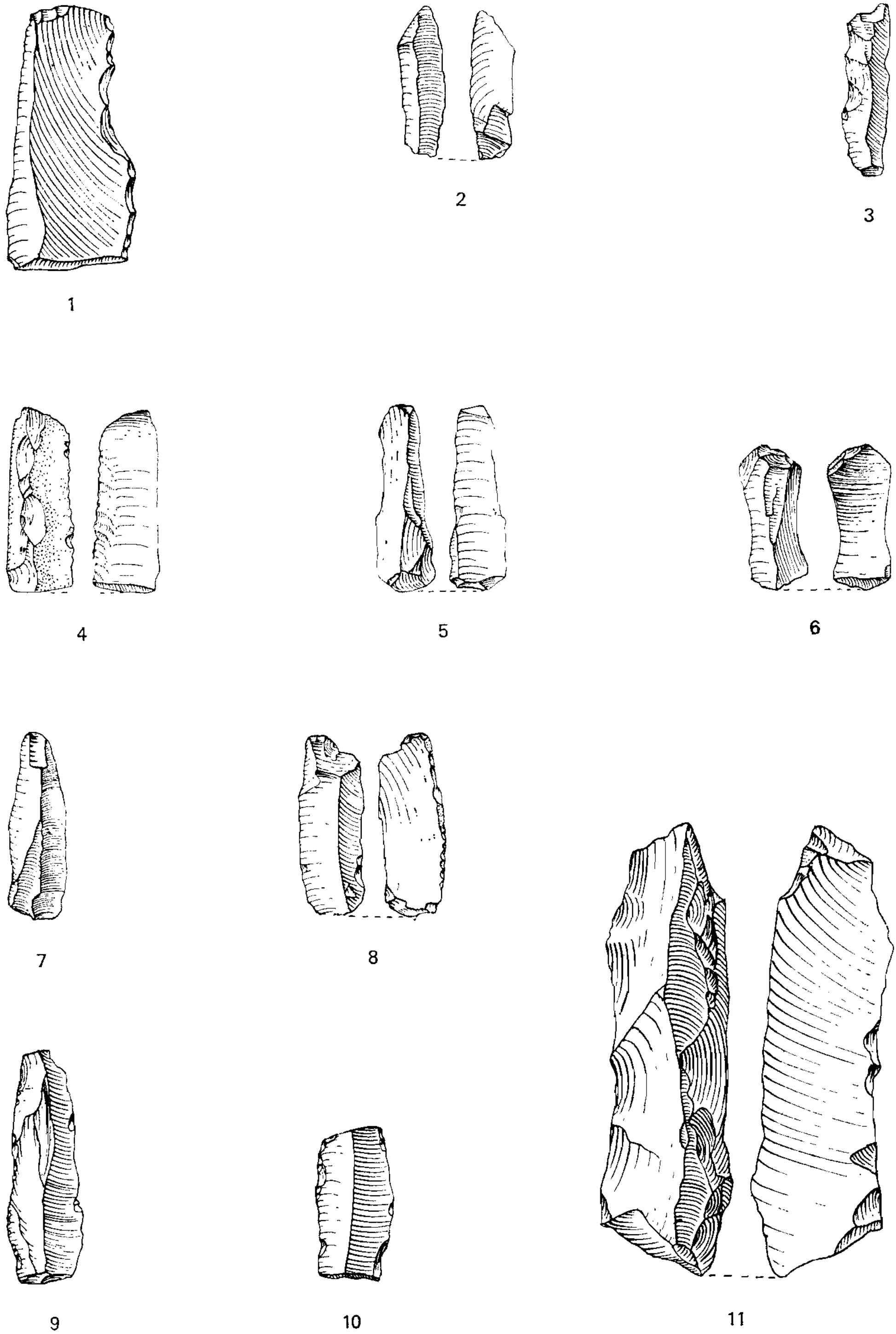

Fig. 4 Blades (approximate scale 1:2).

Blades

Blades dominate the collection; the important aspect, however, is the absence of blunted back blades.

These blades are parallel-sided, slender, and elongated. There are 160 blades in this collection, out of which 37 are points, three are burins, and six are knife-edged tools; two are arrowheads. Among those remaining, 103 are simple blades or blade blanks, a few of which are frequently retouched (nos. 1–11, Fig. 4), 12 are broken, and 13 are irregular. About 25 examples have one side thick, while the other side is thin and sharp. This thick side is not due to blunting; it is natural. All of these were made on limestone and possess triangular cross-sections; retouch along the edges is rarely seen. As explained earlier, the blades which are neither shaped into tools nor retouched are treated as cutting tools on blade blanks.

The striking platform in the majority of blades is simple, while in some it is faceted. No bulb is seen in almost any of the examples, and some of the blades are thick and crude in appearance. The encrustation of lime on the artifacts was less in the upper levels when compared to lower levels; encrustation was greater on the artifacts where the soil was wet or more compact. On the whole, these blades appear cruder than those from Yerragondapalem.

The regular tools are described as follows:

Burins (nos. 12–17, Fig. 5)

There are 20 burins in the collection, three on blades, ten on split cores, and seven on flakes. These 20 burins can be further classified based on the nature of working at the burin edge:

1. *Central:* There are 11 burins in which oblique spalls from either side intersect each other, resulting in the burin edge.
2. *Bevel:* There are six burins in which a vertical spall intersects an oblique spall, the spall being single or multiple.
3. *Rectangular:* There are two burins in which a vertical spall opposes a transverse spall, the spalls being single or multiple.
4. *Convex:* There is only one specimen of this type, in which a vertical spall intersects a convex spall, the spalls being single or multiple.

Points (nos. 18 and 19, Fig. 6)

There are 42 points in the collection; 37 are made on blades and the remaining five on flakes. The flakes are large and thick. One of the flakes is on sandstone, while all the examples on blades and flakes are in limestone. In all these specimens, the point is achieved either by working at one end (23) or is naturally obtained (19). Two of these points are leaf-shaped with a tang, while the rest are simple. Five specimens possess a notch on the upper surface at the distal end, probably to facilitate hafting. A few of the points have broken tips.

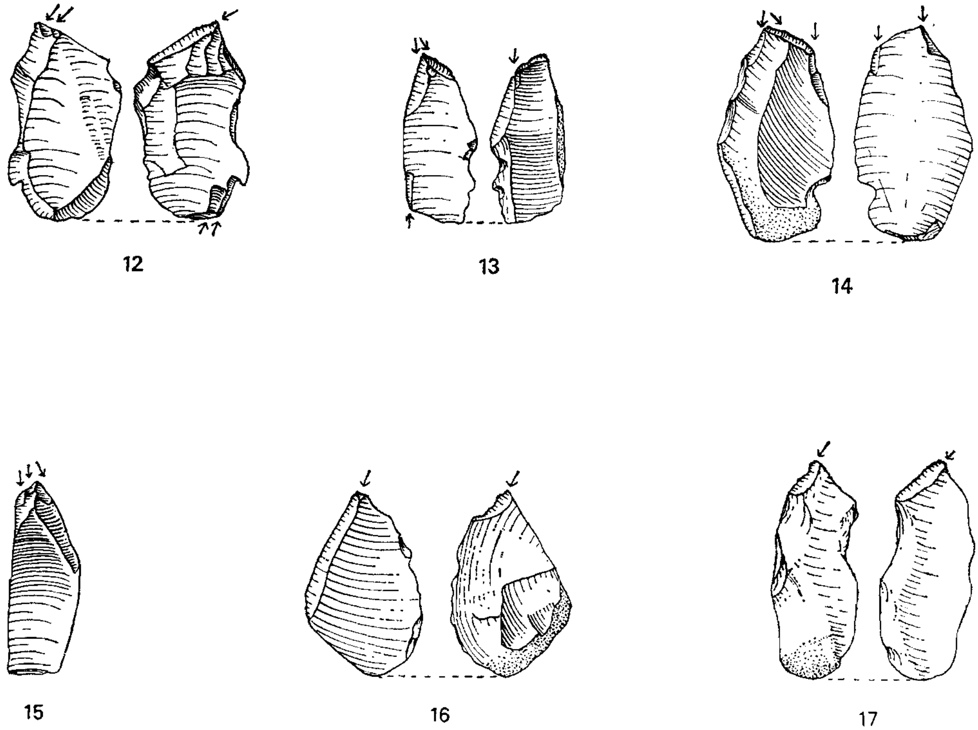

Fig. 5 Burins (approximate scale 1: 2).

Arrowheads (nos. 20–25, Fig. 6)

There are 11 arrowheads, all made on blades. The tip end is achieved by working at one end (4) or is naturally obtained by tapering sides. Seven of these are tanged (nos. 22–25), while the remaining four have a deep and wide notch at the distal end extending over more than half of the upper surface. This notch facilitates hafting. Among the tanged ones, all except one are single shouldered; a notch is made at the distal end on one side. Four examples are deeply patinated, and in two cases it is difficult even to make out the raw material. Two of these are broken at the tip end.

Borers (nos. 26–30, Fig. 6)

There are nine borers in the collection; all are made on flakes. One example is made on a large side flake. Four flakes are of the Levalloisian type—slightly elongated and triangular in shape. The projected point in all the specimens is achieved by making notches at one end on either side or one side. The boring point in all the specimens is thick.

Knife-Edged Tools (no. 31, Fig. 7)

There are seven knife-edged tools, six on blades and the remaining one on a large flake. All the examples possess a naturally obtained oblique cutting edge at one

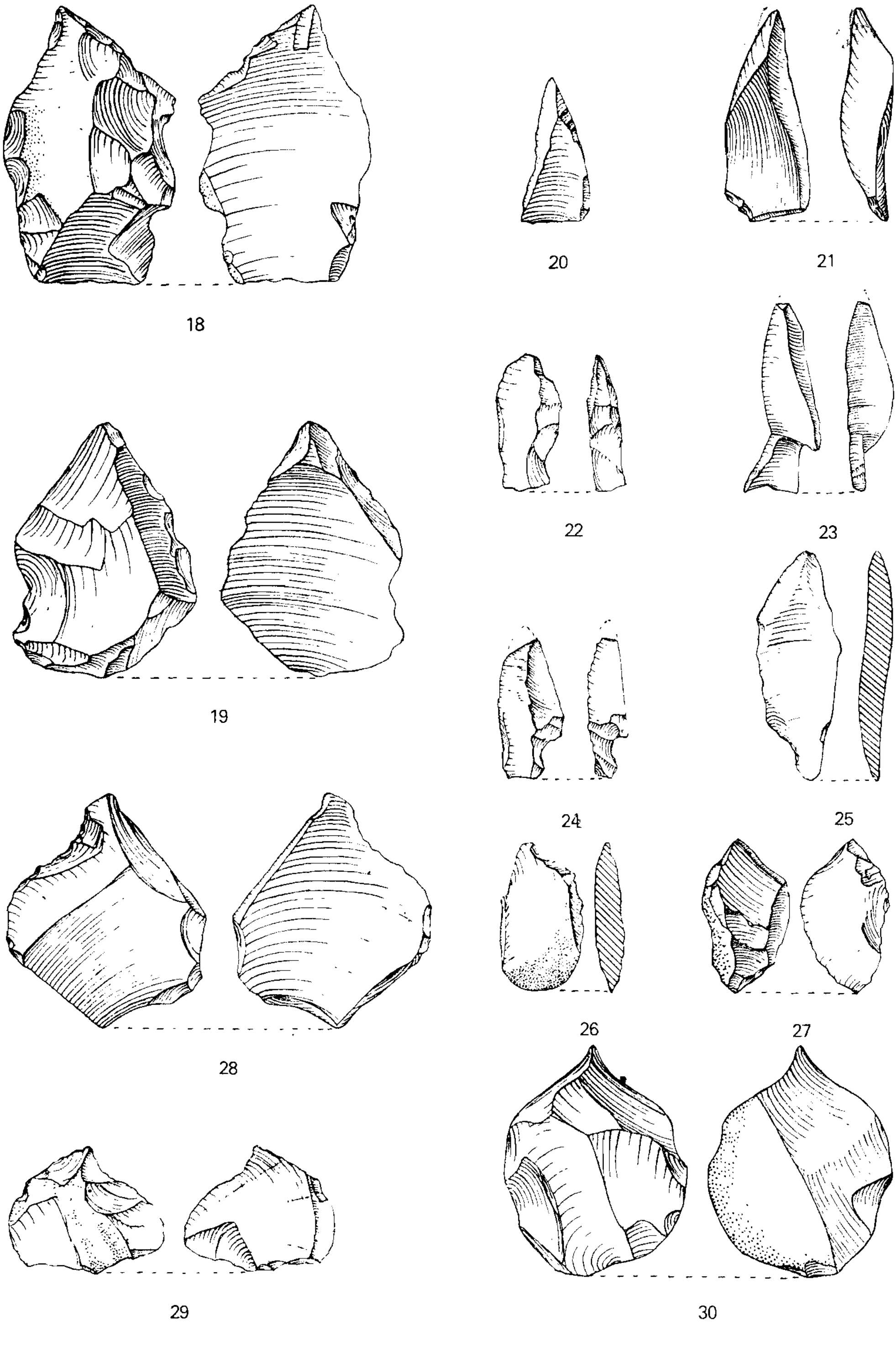

Fig. 6 Points *(18–19)*, arrowheads *(20–25)*, and borers *(26–30)* (approximate scale 1:2).

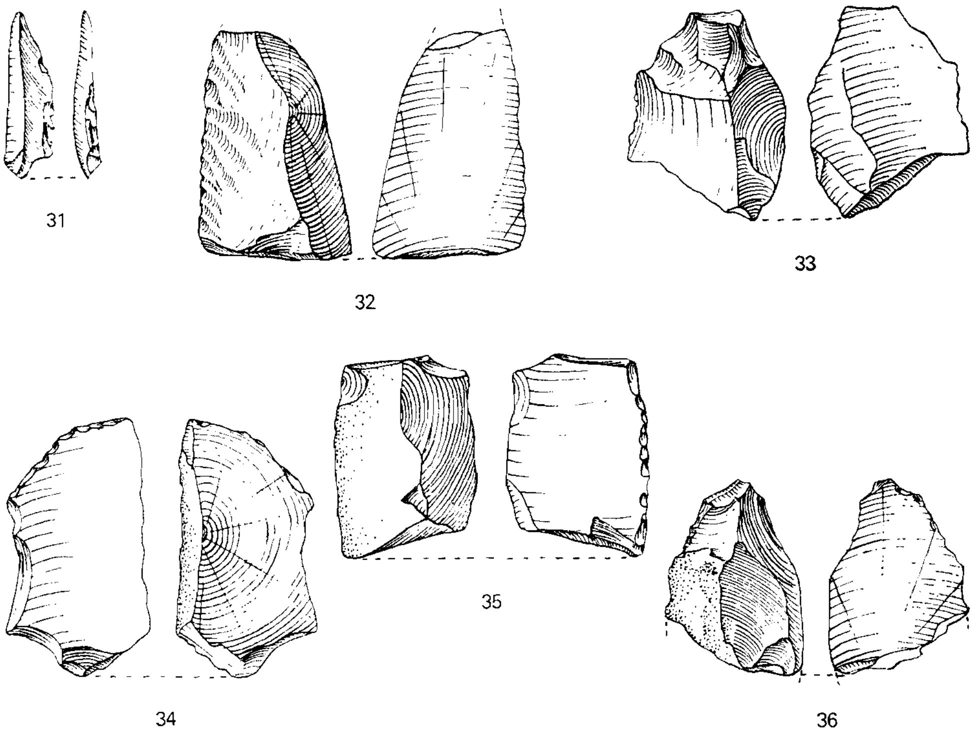

Fig. 7 Knife-edged tools *(31)* and scrapers *(32–36)* (approximate scale 1 : 2).

end. The lateral side opposite to the oblique edge is invariably thick; this oblique side forms the knife edge. An intersecting aspect in the case of the flake tool is the tang, achieved by working, which can be comfortably held in the hand. Barring the last one, these knife-edged tools might have been used as a cutting tool if a finger were kept on the thick side.

Scrapers (nos. 32–36, Fig. 7)

There are 48 scrapers, all made on flakes. The flakes are either triangular or roughly rectangular in shape. Some of the examples possess a plain striking platform, while the rest have no platform. A few among those which possess striking platforms are faceted; the bulb of percussion is absent in the majority. Some of the flakes show a negative bulb of percussion on the ventral surface. Most of these have one thick side, while the other is thin and sharp. Retouch is rarely seen, and where present is poor. In view of the facts of retouch previously explained, it is difficult to classify these under different subtypes, such as single-side, double-side, convex, concave, and so on. Three of these scrapers possess a deep notch on one side which might have been used as "spokeshaves."

All the specimens are made of limestone, and most coming from the lower levels have lime encrustation. An interesting feature is that some of these bear linear scratch marks along and vertical to the edge, as if pressure chipping had been done.

By-Products

Cores (nos. 37–40, Fig. 8)

There are 199 cores, out of which 10 were converted into burins. The remaining 189 cores comprise (1) blade cores, (2) flake cores, and (3) miscellaneous.

1. *Blade cores* (63): The majority of these have a split base; a few are split along the longer axis also. They bear two or more blade scars. Some have one platform, but most have multiple platforms from which blades have been taken out. All are of limestone.
2. *Flake cores* (79): Flakes, one or more, are taken out of these cores in an irregular fashion. Three cores are on quartzitic sandstone; the remaining are on limestone.
3. *Miscellaneous* (47).

Core Flakes (nos. 41–43, Fig. 8)

There are six core flakes. These result from the splitting of residue cores for further removal of flakes.

Flakes (no. 44, Fig. 8)

There are 396 flakes. Most are simple. The number of Levalloisian flakes is less; these are irregular in shape and most of them have thick sides.

Chips

There are 517 chips.

Hammerstones

It is interesting to note that about 10 hammerstones with battered marks were recovered from the excavations. All of them are of sandstone.

Bone Tool Industry

The bone tool industry is not very rich, as stated earlier, because of the limited excavations and the fragile condition of some worked bones, which cannot be treated, with certainty, as worked and finished forms. The bone artifacts, numbering 147 in total, include (1) finished forms, (2) worked bones, and (3) bone blanks. The splinters are not counted as artifacts since it is difficult to distinguish those resulting from human action from the specimens which are more likely to have been produced by crushing from natural agencies such as rockfall, pressure of the debris, and so on. Most of these artifacts come from the second layer. Finished forms are made on bone blanks as well as cut bones.

Close observation of the cut bones, worked bones, bone blanks, and finished forms throws some light on bone-working technology. First, chopping off the epiphyses of long bones, preferably at both ends, was done. Second, parallel grooves were made along the long axis of the bone. Long strips with parallel sides were removed by splitting along these grooves. This phase is indicated by the examples recovered from the adjoining cave by Murty (1974). Such bone strips

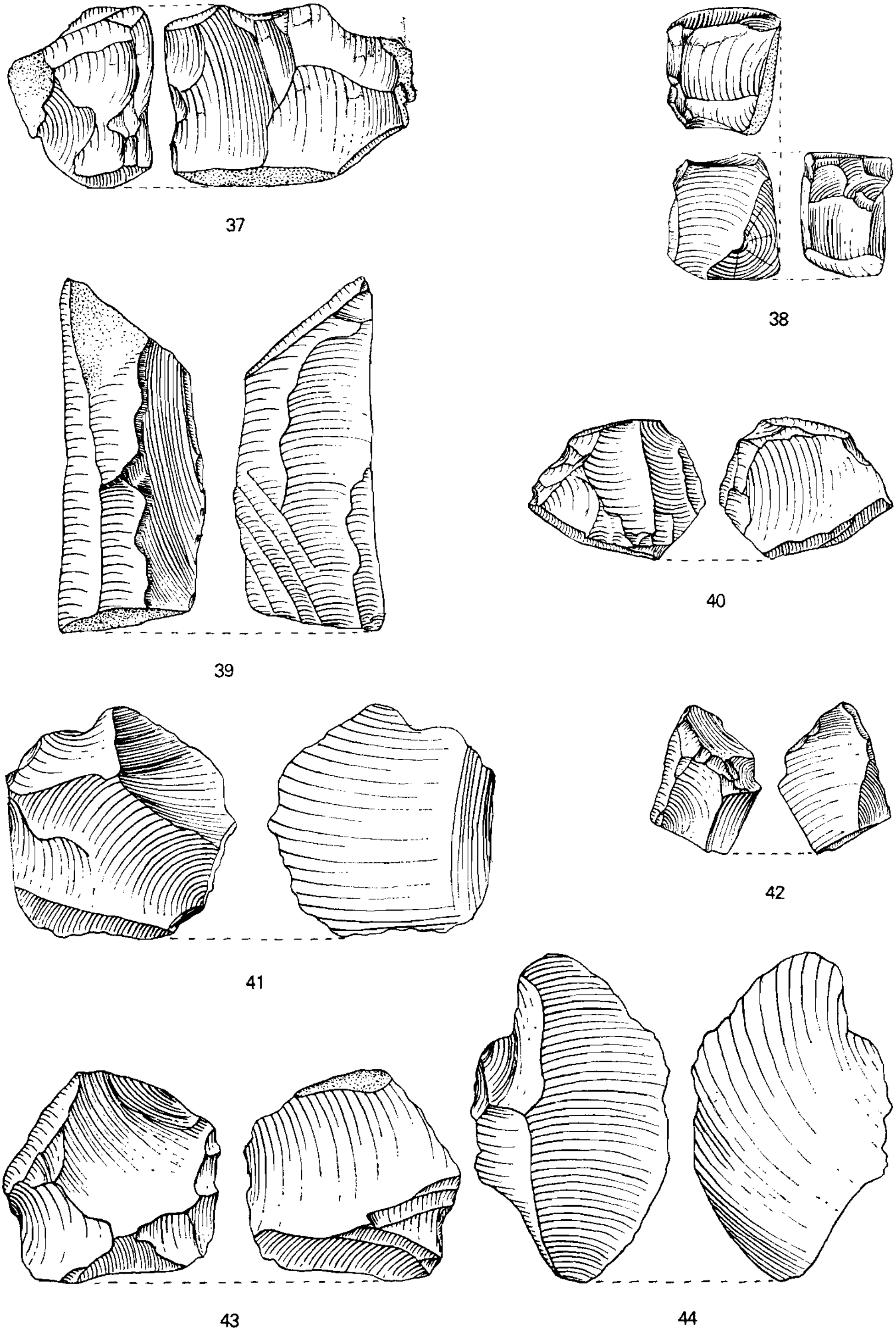

Fig. 8 Cores *(37–40)*, core flakes *(41–43)*, and flakes *(44)* (approximate scale 1:2).

with parallel sides are called bone blanks, some of which were converted finally into finished tools by vertical or pressure chipping. Some of these tools also show partial grinding.

Finished Tools

The finished bone tools, numbering 47, include points (21), chisel-edged tools (8), perforators (7), spatulae (6), and scrapers (3).

Points (nos. 45–51, Fig. 9)

The points include tanged points (4), shouldered points (3), and simple points (14). The pointed end is obtained by pressure flaking or chipping. The tang (nos. 45–46) in the first type was achieved by vertical chipping and pressure chipping at one end. Two examples are broken; one at the tip end, another along the longer axis. Working is very clear in these specimens, while on one fragile specimen little working is seen.

The shoulder (nos. 47–48) in two examples was obtained by oblique chipping on the dorsal at one end; in the case of another example, pressure chipping resulted in a shoulder. The pointed end is broken in two examples.

Simple points (nos. 49–51) are greater in number. One was made on a thick elongated narrow bone blank. Pressure chipping is noticeable both at the base and the pointed end in some cases. Four specimens are broken at the base, two are made on burnt bones, and one is partially ground.

Chisel-Edged Tools (nos. 52–56, Fig. 9)

These are all made on bone blanks, and three of them are thick. The chisel edge is obtained by oblique chipping on either side at one end in five specimens (nos. 52–54) while on three examples oblique chipping is confined to one side of the end. One specimen is broken at the base; another possesses partial pressure chipping on one side.

Perforators (nos. 57–60, Fig. 10)

Oblique chipping is seen on one side of the pointed end on three specimens (nos. 57–59), and on both sides on three examples. Two specimens are partially ground at the pointed end.

Spatulae (nos. 61–62, Fig. 10)

Three of these are made on broken bones, while the remainder are made on thin blade blanks. They are either vertically or obliquely chipped at one end. One specimen is broken at the tip; one shows partial pressure chipping on one side. All are ground at the tip on the ventral side; one is slightly ground on the dorsal.

Scrapers (nos. 63–64, Fig. 10)

The working edge was obtained by pressure chipping. One specimen has an oblique working edge at one end extending to one side which is partially ground. Another has a notch, while a third shows partial pressure chipping on one side.

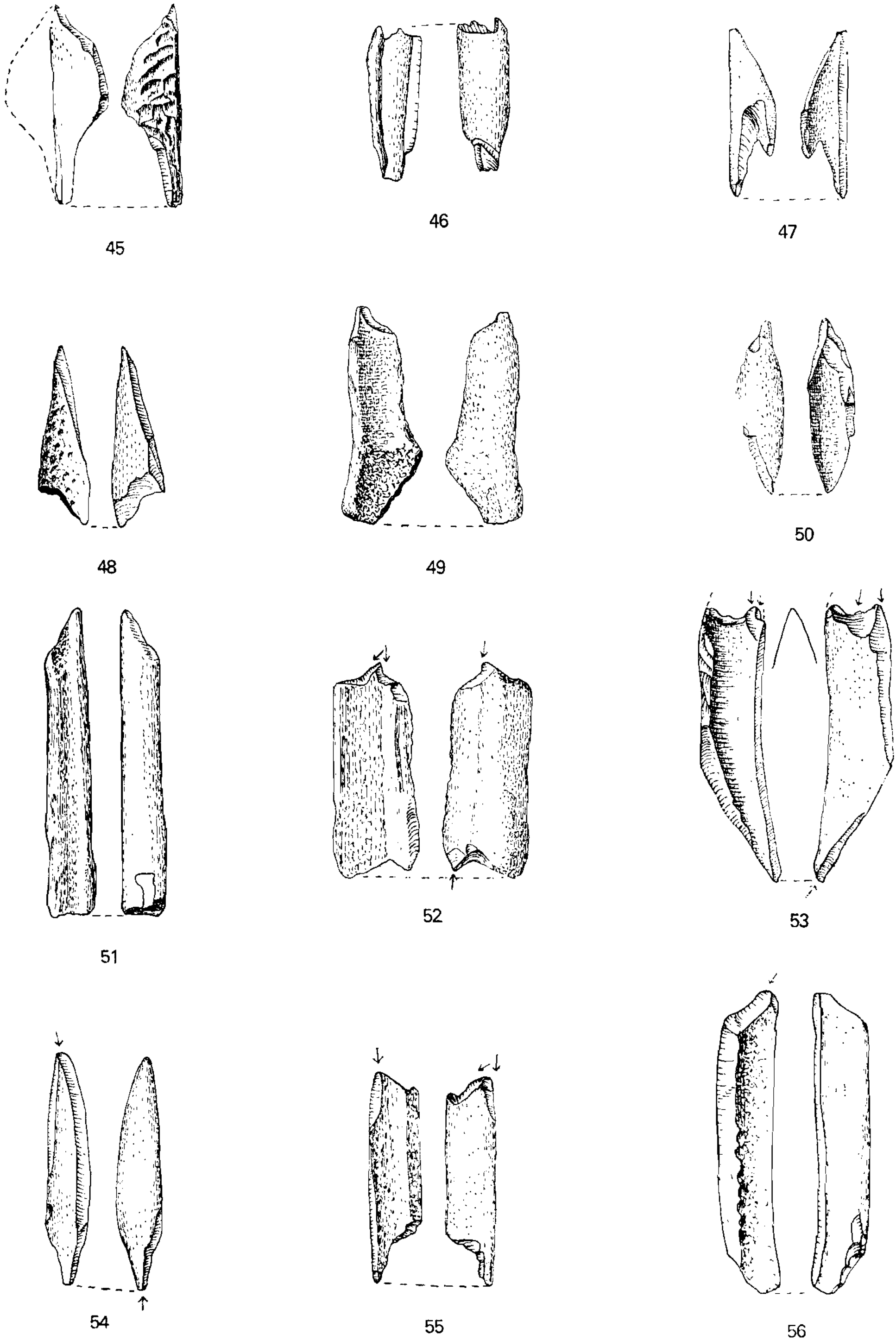

Fig. 9 Bone points *(45–51)* and chisel-edged tools *(52–56)* (approximate scale 1:2).

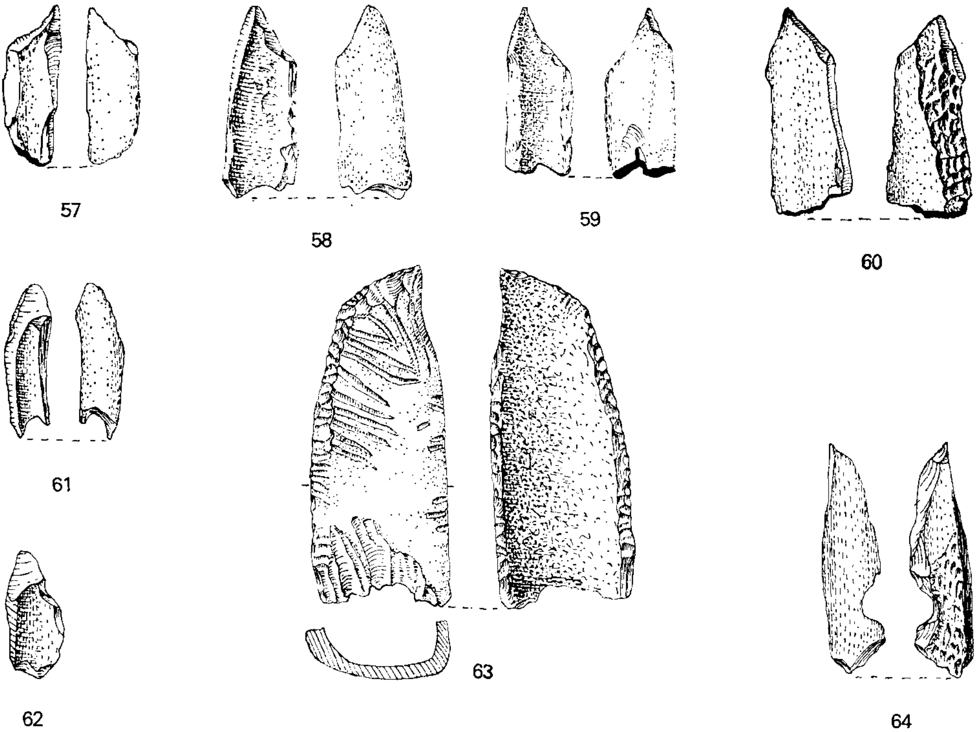

Fig. 10 Bone perforators *(57–60)*, spatulae *(61–62)*, and scrapers *(63–64)* (approximate scale 1 : 2).

Worked Bones (no. 65, Fig. 11)

These, numbering 62, are irregular in shape and show partial chipping.

Bone Blanks (nos. 66–70, Fig. 11)

These, numbering 38, are parallel-sided strips of bone with a thick cross-section. Some are very fragile but retain the shape.

Decorative Objects (no. 71, Fig. 11)

Two perforated bone objects are also in the collection.

Faunal Remains

The faunal remains constitute 949 specimens (Table 3), out of which 39 are from Billasurgam. The dental remains number 318, while the remaining 631 are osteological. The dental remains include complete (148) and fragmentary (170) specimens. They occurred as detached teeth and fragments of jaws, either with premolars, molars, or canines. The osteological specimens are either bones (56), portions of bones (152), or bone splinters (423). Some of the broken bones or portions of bones are worked.

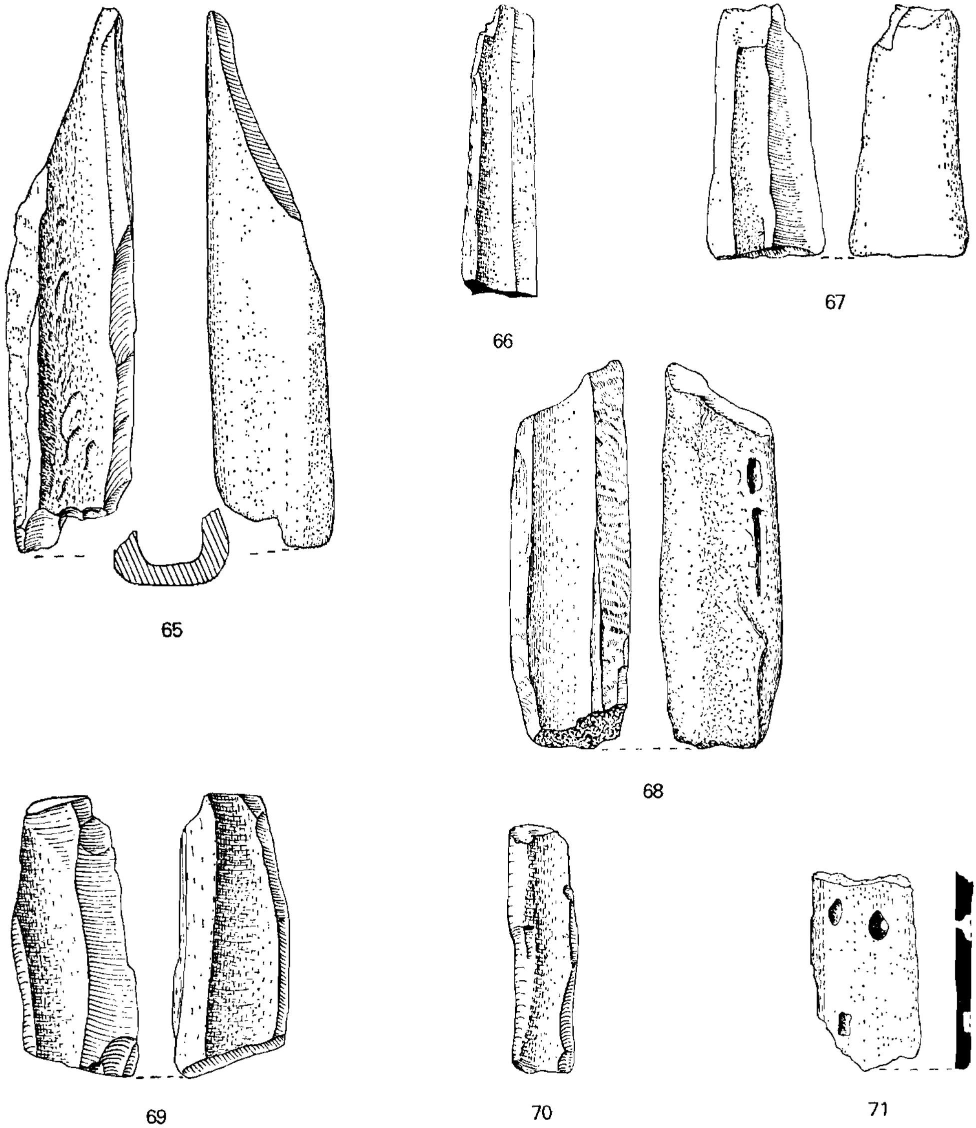

Fig. 11 Bone: worked *(65)*, blanks *(66–70)*, and decorative *(71)* (approximate scale 1:2).

TABLE 3. DISTRIBUTION OF FAUNAL REMAINS BY LAYER

LEVEL	DENTAL REMAINS		OSTEOLOGICAL REMAINS			TOTAL
	COMPLETE	FRAGMENTARY	COMPLETE	BROKEN	SPLINTERS	
Layer 1	90	87	37	56	181	451
Layer 2A	31	35	12	39	153	270
Layer 2B	27	48	7	53	86	221
Layer 3	—	—	—	4	3	7
Total	148	170	56	152	423	949

Some of the bones, however fragmentary, are well preserved for individual identification, while the majority are very fragile. Some specimens are well fossilized or mineralized. The broken bones are in the majority in comparison to the complete bones. The bone splinters might have been produced by working on bones or by natural agencies like the pressure of rockfalls or debris. The complete bones include metacarpus, metatarsal, fibula, pelvis, astragalus, phalange, metapodia, femur, tibia, humus, vertebra, ulna, centrum, atlas, and pastern, all belonging to different animals of Late Pleistocene times and some of which are extinct. A tentative identification of dental remains (Plate I*b*) and bones shows the following list of species (terminology is after Ellerman and Morrison-Scott 1966):

MAMMALIA	
Primates	*Presbytis* sp.
Carnivora	*Felis* sp.
	Viverra
	Hyaenid sp.
	Ursidae
	Canis sp.
Rodentia	*Lepus*
	Mustelidae
	Leporidae
Perissodactyla	*Equus* sp.
	Cervus sp.
Artiodactyla	*Bos* sp.
	Boselaphus sp.
	Tetracerus sp.
	Sus sp.
	Antilope sp.
	Ovis sp.
Reptilia	*Varanus*

Palaeoecology

It is fairly possible to draw a palaeoecological picture from the species just listed that were recovered from the Upper Palaeolithic levels of Late Pleistocene times. The present dry hilly and plateau track of the limestone region of Betamcherla might have supported a scrub-to-tree jungle with thick grass cover and, at places, swamps. Arboreal animals like *Presbytis* inhabit a terrain of rocks and cliffs with shady groves and water in the vicinity. The carnivores, comprising *Felis* sp., *Viverra, Ursidae,* and so on also indicate a bush jungle. Animals like *Antilope* sp. and *Equus* sp., which move in flocks in jungle forest with water resources, are indicated by dental and bone remains. Further, the remains of *Rhinoceros* sp. reported from Billasurgam cave itself and from Muchchatla Chintamanu Gavi by Foote and Murty have disappeared from South India. They suggest a swampy grass and forest environment during Late Pleistocene times.

Thus, the faunal evidence from the present limited excavations in the Kurnool caves indicates a thicker vegetation cover comprising grass and forest jungle with water sources. This suggests a more humid climate during Late Pleistocene times than at present.

Most of these species, except the domesticated forms like the ox, sheep, goat, pig, and so forth, have disappeared from this area. However, the adjoining Nallamalai and Palakonda forested hill ranges of the Eastern Ghats are still inhabited by some members of these groups. The probable reason for their disappearance could be a climatic change from humid to arid conditions, resulting in changes of vegetational pattern and also drying up of the subsurface water table, turning this part of the country into a semiarid zone.

DISCUSSION

The foregoing description confirms at the outset the observation made by Foote that Billasurgam was inhabited or frequented by prehistoric man in his early stage of culture. The blade-burin lithic industry, which was not encountered by Foote, is found here in considerable strength. The bone industry, however, is not very rich in its association with the lithic industry. Possible reasons for rich lithic and poor bone industries are: (1) availability of limestone nodules and pebbles, which provided a source of raw material for the blade-burin industry in streambeds; (2) caves with broad openings and sufficient light almost all through the day might have provided temporary shelter where prehistoric man sat and made tools; and (3) the unlikelihood that such caves, with wide openings and "halls" measuring about 15 × 6 m, might have provided shelter to animals where they could be trapped and killed. Excavations both past and present show that narrow cleftlike passages abound in faunal remains and artifacts made of bone. An ethnographic observation of the hunting of such game as rabbits, hares, and porcupines by communities like Yerukalas and Boyas in the area gives a glimpse of the hunting techniques used around rock fissures and cleftlike narrow passages by prehistoric men. Therefore, it can be fairly concluded that trapping and killing of animals was preferred mostly in narrow passages and rock fissures rather than in open caves. A few burnt bones and cut and worked bones indicate that prehistoric man might have made them at least temporary shelters.

The surface finds in the foothills and valleys of Betamcherla include blades and blade tools (Plate I*c*) made on quartzite, limestone, and other materials which are analogous to those found in the cave. Such dispersal of the artifacts in the open country, coupled with the absence of living floors in the caves, indicates the preference of these early inhabitants to live in the open country rather than in caves, where there is also fear of the wild animals.

The lithic blade industry recovered from the present excavation is notable for the absence of backed blades. Backed blades, comprising points, pen knives, and other tools, form an important trait of Upper Palaeolithic lithic industry in the neighboring areas at Yerragondapalem, Badvel, and Renigunta. The technology of making backed blades is certainly an advance over simple blades. A comparison of simple statistical ratios of B/L and T/B between Billasurgam and Yerragondapalem has brought out that the maximum number of blades from Billasurgam fall between

0.35 and 0.55 (B/L); and 0.40 and 0.50 (T/B). Those from Yerragondapalem fall between 0.25 and 0.35 (B/L); and 0.45 and 0.50 (T/B). This indicates that the blades from Billasurgam are slightly cruder than those from Yerragondapalem. This fact, coupled with the absence of backed blades, puts Billasurgam's lithic blade industry into an incipient stage of blade tool technology of the Upper Palaeolithic in this region.

The faunal remains revealed the existence of certain species such as *Presbytis* sp., *Felis* sp., *Viverra, Equus* sp., *Bos* sp., *Boselapherus* sp., *Antelope* sp., and *Rhinoceros* sp., which are not found at present in this region. They indicate a more humid climate than that of today. The change from humid to semiarid conditions might have taken place with the onset of the Holocene period. Thus, the cultural occupation of the caves might have taken place during Late Pleistocene times, as indicated by the archaeological and faunal evidence.

APPENDIX

The faunal remains recovered from Billasurgam by Robert Bruce Foote and Henry Foote comprise the following species, identified by Lydekkar (1886: 120–122):

PRIMATES

Semnopithecus priamus, Blyth
Cynocephalus (cf. *annbis,* F. Cuv.)

CARNIVORA

Felis tigris (or ? leo), Linn.
Felis ? paradus, Linn.
Felis chaus, F. Cuv.
Felis rubiginosa, Geoffr.
Hyaena crocuta (Erxl.)
Viverra karnuliensis, n. sp.
Herpestes griseus, Desm.
Herpestes smithi, Gray
Ursus sp.

CHIROPTERA

Taphozous saccolaemus, Temm.
Phyllorhina diadema (Geoffr.)

INSECTIVORA

Sorex (cf. *caerulescens,* Shaw)

EDENTATA

Manis gigantea, Gray

RODENTIA

Sciurus macrurus, Harda.
Golunda ellioti, Gray
Mus mettardi, Gray
Mus platythrix, Sykes
Nesokia kok, Gray
Nesokia bandicoota, Rech.
Hystrix hirsutirostris, Brandt.
Lepus (cf. *nigricollis,* F. Cuv.)

UNGULATA

Rhinoceros karnuliensis n. sp.
Equus (? 2 spp.)
Bos or *Bubalus*
Boselaphus tragocamelus (Pall.)
Gazella bennetti (Sykes)
Antilope cervicapra (Linn.)
Tetracerus quadricornis (Blain)
Cervus aristotelis, Cuv.
Cervus axis, Erxl.
Tragulus (cf. *meminna*) (Erxl.)
Sus cristatus, Wagner

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The identification of faunal remains was done by Dr. K. N. Prasad, Chief Palaeontologist, Geological Survey of India, Hyderabad, who identified the species on the basis of dental remains, and by Professor K. Hanumantha Rao, head of the Department of Zoology, Andhra University, Waltair, who identified the species on the basis of bones.

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